Salmonid Enhancement Program

1988-89 Update

Fisheries and Oceans Pêches et Océans

BC Ministry of Environment

Canada

90-02943/

Table of Contents

	Page
Director's Report	1
Repairing the Rivers	
Hells Gate: the saga continues	2
No shortage of volunteers far from civilization	3
Inventing Solutions	
Pens produce fish where you want them	4
Little Campbell River makes a little history	4
Joint effort is providing a smoother trip home	5
The little project that could	5
Improving the Flow	
Glendale channel taps huge potential of Knight Inlet	6
Mitchell Lake builders fought ice and snow	7
Working with Nature	
Bringing them back to the Englishman	8
Building up Baynes Sound	8
Channels and fish multiply on the Indian River	9
Looking Ahead	
Education gets a teacher hooked	10
Science asks: What is happening out there?	10
What's for dinner?	11
Who is eating those smolts?	11
Annual Production Summary	12-14
SEP Contribution to 1988 Sport and Commercial Catches	15

SEP Expenditures by program (in thousands of dollars)

Enhancement Operations	17,667	17,928
Major Production (Construction)	3,745	3,684
Pilot Studies	0	426
Public Involvement	1,520	1,473
Community Economic Development	4,665	4,688
Minor Production	2,542	2,187
Provincial Program (Federal share)	320	0
Program Planning, Support & Direction	752	827
Pacific Salmon Foundation	25	150
Lake Enrichment	1,887	1,665
Manageability/Mark Recovery/Tag Program	344	879
Reconnaissance & Feasibility	622	358
Canada/U.S. Operations/Maintenance	1,911	2,316
Evaluation/Planning	753	500
Research/Science Related Studies	2,662	2,457
Provincial Program (Provincial share)	1,470	1,470
Department of Fisheries & Oceans	39,415	39,538
Province of B.C.	1,470	1,470

Note: Contribution Employees' Benefit Package is not included in 87/88 and 88/89 expenditures. This is approximately 14% of total salary cost and in 1988/89 the cost is estimated at 1.7 million which brings the contribution by the Department of Fisheries and Oceans to 41.2 million in 88/89.

Department of Fisheries and Oceans
Salmonid Enhancement Program
555 West Hastings Street
Vancouver, BC V6B 5G3

Director's Report

As the new Director of SEP, I spent much of 1988-89 in discovery and investigation. But it was also, for all of us, a time to prepare for change.

Change, in this case, is needed not to correct, but to build. Over its 12-year history, SEP has amassed an impressive list of achievements, but the world in which we operate is changing and SEP must respond.

Each of the past several years has seen greater demand for every government dollar; that has an impact on SEP. All three fisheries sectors are changing; SEP will feel the effects. As well, public concerns and expectations are shifting and SEP must prepare for new challenges and opportunities in the next decade.

As I became acquainted with Pacific Region, I was looking for signs of change and seeking appropriate new directions for SEP. A series of conversations with government colleagues, industry leaders and academics helped to identify some trends. Discussions with SEP staff produced concrete ways to begin preparing to meet them. While clear evidence of change will generally be felt in 1989-90 and beyond, we were able to make plans and begin the process.

One of the first moves was devising a way to combine administration of the Community Economic Development Program (CEDP) with the Public Involvement Program (PIP).

Three new Community Advisors were announced for PIP in 1988 and that, with the decentralization of CEDP Project Coordinators, will effectively create six more field-based staff for the combined program, to be known as the Community Involvement Unit. Each Community Advisor will provide support to both contract and volunteer projects within an assigned geographic area. This began as an experimental effort in 1988 but its value was evident and full implementation occurred early in 1989.

Two future directions are reflected in these changes. The geographic divisions of the Community Involvement Unit will parallel those of Fisheries Branch. This will facilitate more immediate and effective cooperative efforts and encourage active SEP participation in the regional planning process. As well, additions to our field staff will allow SEP to respond to more requests from community groups. Specifically, five additional locations will receive technical assistance in 1989 and there will be additional support in the Lower Mainland as well.

Other changes indicated for SEP were identified over the past year and will be implemented in 1989-90.

SEP faces further staff reductions, met through attrition, early retirements and delayed hiring, so the need to "do more with less" is still very evident. We will be encouraging innovation and problem-solving to meet that challenge.

We plan to emphasize small-scale, semi-natural approaches as a way to control operating costs, reduce risk and spread the benefits of enhancement among more of the region's streams and rivers.

We will increase habitat restoration and improvement activities to meet SEP's responsibility as the local operational arm of the DFO national "net gain" habitat policy.

We have also devoted attention to preparing for the assessment projects that will be required for an evaluation of SEP to be conducted in 1991 or 1992 and for new co-operative projects to be undertaken with Biological Sciences.

While preparing for change occupied much of the year, there was time to note that past efforts are producing benefits. Chinook returned to the Cowichan River in better numbers than expected in 1988, providing a welcome bright spot amid ongoing concern for this species. Chum returns to the Nitinat were outstanding. Coho returned to the Capilano and west coast of Vancouver Island hatcheries in very high numbers and chum returning to the Kitimat area were sufficient to sustain the first commercial chum fishery there in 31 years.

Production of juveniles also showed promise with pink survivals at 80 percent — well above projections — in the new Glendale spawning channel at Knight Inlet.

Past successes, including these, have been substantial. With increased knowledge from scientific programs such as Marine Survival of Salmonids (MASS) and with new, coordinated planning methods, SEP can anticipate increasing its rate of success into the beginning of the next century.

David Griggs
Director, SEP

Repairing the Rivers

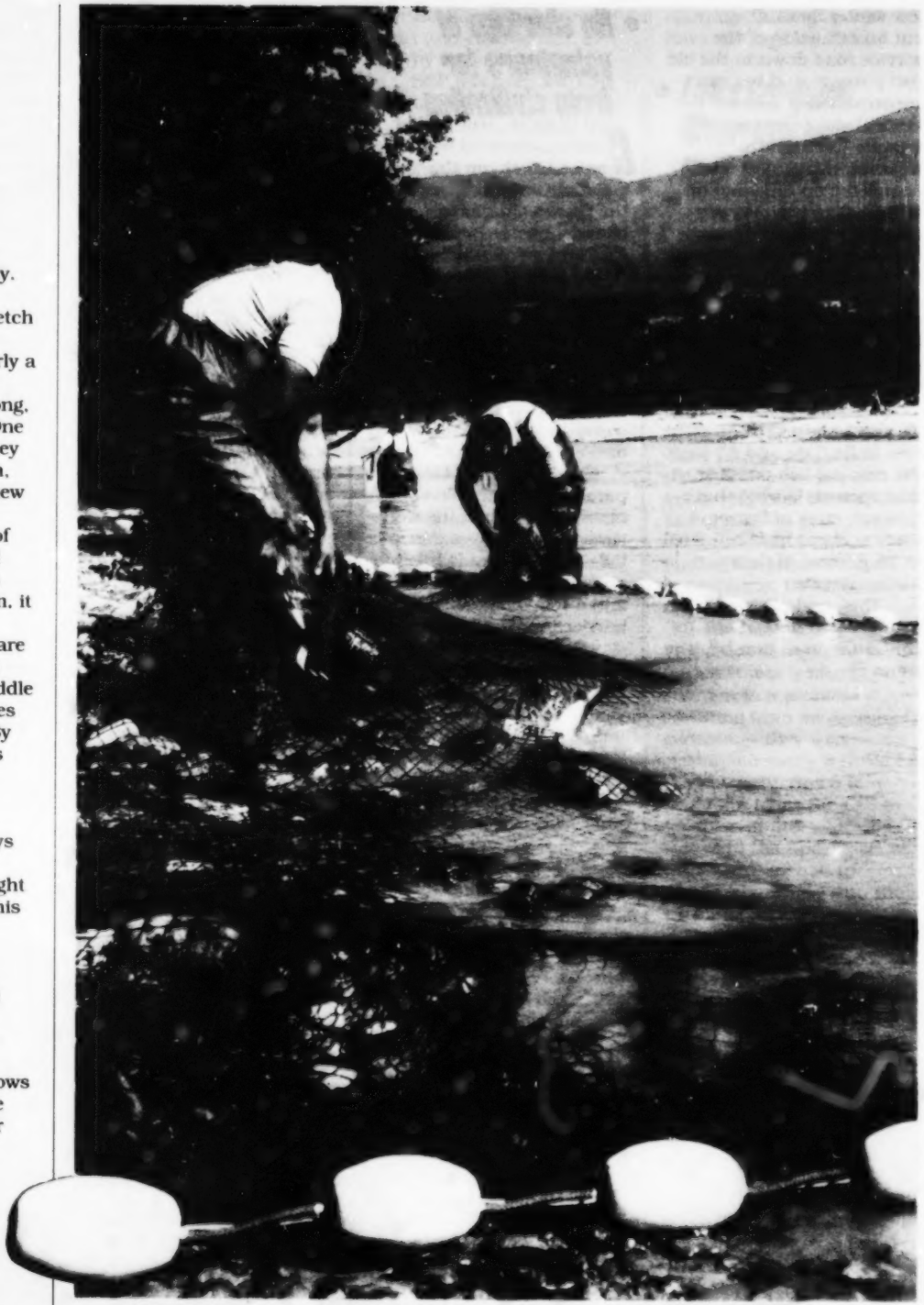
• Hells Gate: the saga continues

Hells Gate was a tragedy. Tons of rock turned an already tumultuous stretch of river into an almost impassible torrent. Nearly a century of concern and effort has marked the long, slow road to recovery. One more step on that journey was completed in March, with construction of a new low-level fishway.

The complications of the Fraser Canyon need some explanation. Hells Gate is not THE problem, it is part of the problem. These notorious rapids are the last, and worst, in a series that begins at Saddle Rock, some 10 kilometres (6 miles) downstream. By the time fish reach Hells Gate, they are close to exhaustion. Also, the original low level fish passages were not always adequate to pass the numbers of fish that might arrive on a given day. This forced the flagging creatures to wait, in a raging current, for a chance to move through the passage.

The past few years have seen several incidences of very low flows during pink and sockeye migrations in September and October. This highlighted a problem; the existing low level passage, built to a weir design, simply could not handle enough fish per hour at these very low water levels.

During the winter of 1988-89, despite the bitter cold spell in February, SEP crews were at work on the Fraser. Taking advantage of



The production of more fish, whether it is being done in a major SEP hatchery or at a volunteer-operated incubation box, starts with capturing adult spawners to obtain eggs. Every fall, SEP staff, CSRP contractors and FIP volunteers enact some version of this scene on the Nanaimo River, where beach seining provides an egg supply for Tenderfoot hatchery near Squamish, B.C.

low winter flows, they cut an extension of the service road down to the old fish passage and began construction of a new, vertical slot fishway. Despite the frightful weather, the project was completed on time and on budget. The new fishway basically replaces part of the old system and overlaps it. Now, fish can pass at virtually all water levels although some delays can be expected if large numbers of fish arrive within a short time period.

It has been more than 76 years since rock plunged into Hells Gate and 43 since the original fish passage was opened. During that interval, runs of Fraser River sockeye have returned to 75 percent of their historic levels.

This, and planned future work, should ensure continuation of that healthy trend.

• No shortage of volunteers far from civilization

Coates Creek, on the west coast of Graham Island in the Queen Charlotte Islands, boasted miles of excellent salmon habitat, three lakes and the drainage from one of the largest watersheds on the west coast of the islands. Only one thing was missing — salmon. Coates hosts no run in modern times and, so far as we know, it never did.

The reason for this paradox becomes obvious near the mouth of the river. Here water plunges over a falls into Port Louis Inlet, providing a scenic wonder and a totally impassible barrier to migrating salmon.

Coates Creek offered a golden opportunity for fishway construction and a stocking program. Unfortunately, it also offered a logistics and cost barrier almost as impassible as the one facing salmon. The location is remote and access is difficult so tackling such a project seemed unlikely, at least until 1983 when a group of very determined people got together.

They made Coates Creek a focus for the combined efforts of the Queen Charlotte Islands Public Involvement volunteers, several branches of DFO, other government agencies and private industry. The project, ramrodded by PIP volunteers, began with assessment and disease profile work in 1983/84 when staff from Pacific Biological Station made the long pilgrimage to Coates to clear the way for the necessary stock transplant.

Three years of major construction followed. Two DFO patrol boats ferried in tons of construction materials, food, equipment and supplies from Masset and Queen Charlotte City. Local Fisheries Branch staff donated use of skiffs, motors, radios and other essentials, as did Pallant Creek hatchery and Canadian Forces Station Masset. A mini construction camp — tents and a log cabin — sprang up in Port Louis. The Resource Restoration Unit of SEP supplied invaluable engineering and blasting expertise.

It took two summers for a crew of volunteers and Canada Job Strategy employees to shape the previously formidable rock barrier into a series of pools and slotted runs, making it possible for salmon to swim into Coates Creek for the first time ever. One problem remained; where would those salmon come from?

Experts at the Pacific Biological Station and the Federal/Provincial transplant committee supplied the answer; Yakoun River coho stocks would be suitable.

So, to fulfill the project, the Masset Community Economic Development Project has been taking extra broodstock for the past three years. The eggs are incubated at the CEDP hatchery to eyed stage,

After spawners have been captured, they are taken to the hatchery and held until the eggs are ripe. If the capture site is a distance from the hatchery, special tank trucks are used for the transport.

then turned over to the Sandspit Enhancement Group. There, the fry are raised to 3 grams, then airlifted by helicopter to the Coates system.

These fry are marked with coded wire tags so that fisheries managers will be able to assess the level of sport and commercial interception of the Coates fish. This will be especially useful as no data of this sort have previously been available for rivers flowing to the west coast of the Queen Charlottes.

"Everyone can really be proud of this project," says Community Advisor Tom Rutherford. "Without a truly cooperative effort from the volunteers, SEP staff, Fisheries Branch, Ships Division and many others, it would have remained impossible.

"It's tremendously rewarding to know that we can stock Coates Creek for two cycles then let the system sustain itself. These people have given B.C. a new salmon river."

Inventing Solutions

• Pens produce fish where you want them

Historically, Vancouver's North Shore rivers lacked chinook runs. Today, in this busy urban area, the opportunity to create a chinook sport fishery is unique. Ideally, this would require fish with high survival rates that would remain within Georgia Strait while growing to maturity and would return to known sites in Burrard Inlet during the peak of the salt water sport fishery season.

A custom-tailored fish? Amazingly, it is possible.

To create that dream fish, SEP selects an appropriate stock, then takes steps to make it return to a spot in Burrard Inlet. For example, a Slim Creek smolt, its early survival chances increased by acclimatization in a sea pen near Wigwam, will likely return, as an adult, in June and spend several weeks near Wigwam before seeking a spawning stream.

SEP has conducted several experiments with holding hatchery smolts in salt water net pens. Survival rates have been dramatic as compared to river releases from the same brood. As well, it appears that fish released from such pens usually return to the pen site. Now a project involving both SEP Operations and the Public Involvement Program is putting that knowledge to work in Burrard Inlet, Indian Arm and Howe Sound. Ultimately, the Georgia Strait sport fishery will benefit. So will fisheries, sport and commercial, in nearby waters.

SEP has been working at Wigwam and Deep Cove in Indian Arm. Most of the fish have been drawn from Big Qualicum or Quinsam River stocks. There have also been experimental releases of fish from Harrison River stock; hatchery raised, then held and fed in pens for ninety days until release. Others, from the Slim Creek strain, have been used, too. Many groups of pen-held smolts were tagged so that different release strategies can be compared for their contribution to sport and commercial fisheries, their survival rates, their time of arrival back in Indian Arm and their contribution to an Indian Arm sport fishery.

An early PIP experiment, at Sewell's Marina in Horseshoe Bay, produced a bonanza for sport fishing in that area in 1988 as coho returned to the site of the net pens that held them as 1987 smolts. For the first time in memory, sport fishing from the dock was successful in Horseshoe Bay.

"The coho came in and were around the bay for two or three weeks," says SEP Community Advisor Gary Taccogna. "A lot of them showed up later at Capilano hatchery — that's the closest major spawning stream for coho."

Both Taccogna and Ted Perry of SEP Enhancement Operations feel that the potential for chinook is similar.

"It's a growing technology," says Perry. "You can use it to target an area where you want to introduce fish without building a permanent hatchery facility. You can make it a tool to rebuild a depleted stock fairly quickly, by raising captive brood stock. Sea pen activities will likely continue as long as we have the eggs available."

• Little Campbell River makes a little history

The Semiahmoo Fish and Game Club's highly successful enhancement project on the Little Campbell River in South Surrey virtually pre-dates SEP. Club members began keeping their own tally of the river's stocks in the early 70s and when SEP came into being they were ready and eager to get involved. From the very beginning, the group has been innovative about finding workable solutions to problems. In 1988, they did it again.

This time it was not a new fence design or a fish feeder, it was a historic solution to a problem resulting from an excess of success — they were getting too many returns to the hatchery. Since they could not allow the fish to escape and mix with wild stocks in the upper part of the river, they had to decide what to do with the surplus — waste was unthinkable.

The club was also aware of a long standing problem on the Little Campbell. Because the mouth of the river is located on a Native reserve, sports fishing was frequently accomplished by trespass, a situation tolerated by the Semiahmoo Band. Since the 1950s, there had been no Native fishery on the Little Campbell; the Band had been getting its fish from a permit on the Fraser River. There were, however, poachers operating on the river — but when sports fishermen spotted a net they were reluctant to report it for fear of

upsetting the Band by casting suspicion on its members. Band members were equally reluctant to stir up trouble by reporting illegal sport fishing practises that they sometimes observed.

By 1985, the club was concerned about the possibility of a Native fishery on the river. If that happened, would traditional sport fishing spots be sealed off? Would the Band's fishery undo some or all of the years of work that the club had invested in the Little Campbell?

The Semiahmoo Band, meanwhile, faced its own problems. The permit holder who had given them access to fish from the Fraser died and the permit lapsed. The federal bill to repatriate people who had lost Native status and rights could result in the Band seeing a three- or four-fold increase in its numbers. Chief Bernard Charles felt strongly that anyone with reserve status also held food fish rights. How could they cope?

It seemed like the time had come to talk. Could the Semiahmoo Band and the Semiahmoo Club reach an agreement?

They could, and they did. The Club agreed to provide the Band with surplus, marked coho from the hatchery fence, and offered to extend the agreement to chum and steelhead in the future if the numbers of fish are there. The Band agreed that, in exchange, they would forgo any Native net fishery in the river, allow continuation of the traditional sports fishery and welcome fishery and conservation officers to patrol the area.

Club members gain assured public access to their favorite fishing spots and cooperation for their enhancement project while Band members gain an assured supply of fish from the club.

"These folks made a bit of history," says SEP Community Advisor Joe Kambeitz, "But the neat thing is, they don't think of it that way. They just see it as both parties having found a solution to a problem."

That, at its best, is history

• Joint effort is providing a smoother trip home

The upper stretches of the Bonaparte River offer 140 kilometres of excellent fish habitat. Excellent habitat that fish couldn't get to. A six-metre waterfall on the Bonaparte, near Ashcroft, presented a very effective barrier.

When SEP was a new program, the site was investigated but action was postponed because of the high cost estimate.

The system has not been going to waste, however. For the past several years, SEP's Spius Creek hatchery and the B.C. Ministry of Environment have been planting fry, with considerable success, above the falls to utilize the rearing capacity of the productive Bonaparte system.

"We started stocking the area in 1979, in hopes that someday we would get funds to remove the falls or build a fishway," says Ian McGregor of the British Columbia Ministry of Environment.

Transplanted fry produced some adult returns, but poor spawning conditions on the lower part of the river negated most of the gains.

The problem was solved when SEP and the Ministry of Environment, with the Habitat Conservation Fund, agreed to undertake a joint project. It was completed for $300,000 in November, 1988.

"The project was a roaring success," says Dr. Art Tautz of B.C. Ministry of Environment, Fish and Wildlife.

"We handled the blasting, drilling, excavating contract and technical supervision during construction," says SEP's Barry Chilibeck "The B.C. Ministry of Environment provided funds for the construction work. I think everyone has been very satisfied with the result. The grade is somewhat steeper than in previous vertical slot fishways, but the fish seem to be handling it fine."

With a clear passage to the upper river, productivity for most species should improve, contributing to the total output of the Thompson River system. It is expected that chinook escapements will number 5,600 and steelhead up to 1,000 in future years. As well, there will be benefits for coho, pink and resident trout.

The Bonaparte fishway will also enhance the depleted Thompson River steelhead run.

"We counted 325 steelhead through the fishway in early 1989," says McGregor, "One of those was found 100 kilometres upstream. We know it's going to be productive."

• The little project that could

The Cowichan River is one of three key chinook producers on Georgia Strait. The others are the Nanaimo River and the Squamish. Public concern about these stocks has been rising for some time. Now, the Cowichan Band CEDP Project is involved in a major upgrading of its facilities to undertake rebuilding of the Cowichan River chinook. Rather than an all-out enhancement effort, the project has set a production goal that will see SEP fish limited

Moving fish is a complex process; the tanks are filled with cold water, and a constant oxygen level must be maintained to minimize stress for the "passengers."

to 50 percent of adult returns. Maintaining genetic integrity is one prime reason for that goal limitation. The other is the capacity of the project site.

Creative solutions have been applied in abundance here. Eggs, provided by SEP from the 1987 Cowichan and Nanaimo brood, are being raised at the IBEC Aquaculture facility to maturity. Approximately 2 million and .5 million eggs will be returned to the Cowichan and Nanaimo facilities respectively in 1990 and 1991. The company retains any fish and eggs surplus to that requirement.

In the meantime, heroic efforts have been made to collect all possible brood stock since 1987.

"The directive was to fill the hatchery to capacity," says Colin Masson, A/Head, Community Involvement. "The facility, originally built for 500,000 eggs, took 760,000 in 1987 and released 95 percent as smolts.

"By 1988, the target was up to 925,000 — if the escapement was sufficient. As it happened, escapement was up and the project was asked to take all it could handle, up to a limit of 1.5 million. Despite difficult water conditions, they collected 1.2 million."

Production at Cowichan had doubled in just two years.

Also in 1988, net pens installed at Lake Cowichan went into operation. These will let the Band produce from 750,000 to one million chinook smolts. As well, the water supply was upgraded and plans have been made to upgrade the entire facility to provide for 3.5 million smolts by 1991, in addition to the existing .5 million coho target.

"The Band has really responded well to the initiative," says Masson. "At the same time, it has retained a co-management role with stream guardians working hard with the entire community to ensure chinook escapements were maintained."

Sometimes, two objectives can be met at one site. Here, a counting fence on the Cowichan River provides data for a chinook assessment project being carried out by the Pacific Biological Station. It also provides a fish trap where the Cowichan Indian Band CERP project obtains its broodstock.

Improving the Flow

It's a long, tough journey from the open Pacific Ocean to a west coast river. Still, many spawners do reach their destinations and find a combination of good spawning gravel and adequate water flow. Spawning proceeds successfully and millions of eggs are deposited in their redds. Exhausted, the spawners perish. If fish think, we must assume that they die believing that the next generation is assured.

Unfortunately, in many coastal rivers and streams, things change after the spawned-out fish are dead. These streams are fed by melting glaciers high in coastal mountains. As winter approaches, glacier melt slows, then stops. Far downstream, the creeks and rivers shrink, slowly exposing the redds. Losses are stupendous. It's a problem the fish could not have anticipated.

In such cases, there is an opportunity for enhancement to make nature just a little better.

• Glendale Channel taps huge potential of Knight Inlet

A new spawning channel at Glendale Cove on Knight Inlet has the potential, when fully developed, to produce one million adult pink salmon annually. Even its initial output should be a substantial 250,000.

Glendale is an ideal site for a spawning channel; natural conditions in the Glendale River limit

At Tenderfoot hatchery, a chute transfers broodstock from the transport tanks to holding ponds in a matter of seconds. While it looks like a wild ride, this swift unloading actually reduces stress on the fish.

fish production largely due to extremely low flows during pink spawning. The channel addresses that problem by drawing stored water through a pipeline from Tom Browne Lake.

Biological studies were originally done on the site some years ago, and an access road was built in 1981/82, but construction really began in 1987. The channel itself was completed and running by August 1988. The channel, built as a package with Kakweiken channel, is 15 metres wide and 1,300 metres long. It is the first phase of a development that could expand to four times its present capacity if assessments prove the location and strategy sound.

The staff of Puntledge hatchery supervised the first year of operation and assessment at Glendale. Thanks to their hard work, 45,000 pink spawners filled the channel for the first time. Later, a downstream enumeration program revealed a surprisingly high egg-to-fry survival rate of 81 percent. With these positive early results, the channel shows great promise of achieving, or even exceeding, fish production targets.

• Mitchell Lake builders fought ice and snow

The Mitchell River would seem an ideal site for a spawning channel. There are abundant Quesnel Lake sockeye stocks and the North Arm of Quesnel Lake is under-utilized as rearing habitat. More production from the Mitchell River could take advantage of that.

Initial reconnaissance in the area revealed that sockeye could reach the Mitchell, where there were adequate water flows for spawning. Unfortunately, eggs laid in the gravel were frequently left dry during incubation as glaciers feeding the system began to freeze.

A flow control dam at the lake outlet was designed to trap summer melt water for winter release into the Mitchell River. Lakeshore property owners were concerned about raising the lake level, so SEP reduced the dam to a height of one metre and excavated a trench to provide a minimum of 130 cfs during sockeye incubation. Fishways and a stop log structure were incorporated, providing a way to open passage for rainbow trout should the project interfere with their spawning habits.

"There was a lot of customizing to satisfy all the concerns and get approval for the project," says SEP engineer, Wayne Peterson.

Once SEP had agreement to proceed, there was a new challenge. Construction had to be carried out in winter, at low water levels, with minimum disruption of the environment and without benefit of an access road. Ultimately, the project

would call on the pioneer spirit in everyone who worked at the site.

Everything: men, equipment and temporary living accommodations, had to be delivered by helicopter. The weather was bitter and four to five feet of snow blanketed the site. Removing it came first, then trench digging could begin. Airlifting limited the size of machines that could be brought in, which made digging painfully slow. Constant repairs were needed as the undersized excavator battled difficult terrain and icy weather conditions.

Transferfast hatchery's recipe for life: take hundreds of chinook eggs, add to a few ounces of milk and a cup or two of water, then stir. Once fertilized, the eggs are placed in trays in darkened rooms, where cold, clean water circulates over them until the next generation hatches.

It was hard on machinery and harder still on men.

"The ultimate had to be standing in the river at -40° C in the downdraft of a large helicopter," says Peterson. "I'm not sure what the wind chill factor on that is, but with the water being sprayed around, anyone nearby became an instant popsicle!"

The project was ultimately characterized by some very productive innovation. Its final appearance makes a minor intrusion on the natural beauty of the area. Log jam removal in the construction zone uncovered a large area suitable as trout spawning beds. The rainbow population should also benefit from a by-product of the actual construction; the coffer dams needed while work was underway were filled with trout spawning gravel. Once the project was completed, this was substituted for the larger rock in the natural spawning areas.

"Both sockeye and trout should benefit," says Peterson. "It's a true win-win solution."

That outcome is SEP's reward for the long hours of work in sub-freezing temperatures.

Working with Nature

Enhancement can take the direct, high-impact route with major hatcheries and spawning channels, or it can look at natural or semi-natural improvements that will pay off more slowly but with little or no ongoing operating cost. Habitat restoration is one approach and several good examples were part of SEP activities in 1988.

• Bringing them back to the Englishman

The Englishman River is fairly typical of streams on the east coast of Vancouver Island. The lower reaches offer limited rearing area and the upper stretches lie above impassible falls. Historically, the Englishman did produce pink, coho, chum and chinook but logging in the watershed plus high fishing pressure took a toll. The result was a system with basically good potential, but very few fish.

There was another interesting feature of the Englishman River; although there had been a provincial steelhead program on the system, there had been no enhancement of salmon stocks.

"The Englishman offered a unique opportunity to try a program of natural and semi-natural enhancement in an area where there were no other enhancement programs for salmon. We decided on sidechannel work for the lower river and coho colonization for the inaccessible reaches," says SEP biologist Bob Hurst.

In 1988, SEP created a spawning and rearing channel with water flows assured by both groundwater and an infiltration gallery. The river was stocked, above the area accessible to spawners, with coho fry obtained from the Little and Big Qualicum projects. For succeeding years, preference for donor stocks for the program will be given to wild stocks from the Englishman itself, followed by Englishman/Little Qualicum hybrids, Little Qualicum wild stocks and, lastly, Big Qualicum hatchery stocks.

Another channel, built in cooperation with MacMillan Bloedel, was begun on the south bank and will go into operation in 1989.

SEP also plans to create a chinook run on the Englishman, using transplants from Big Qualicum as the original donor stock, then taking later eggs from chinook returning to the Englishman for streamside incubation.

"Colonization is an effective technique for rehabilitating stocks that are depressed due to overfishing," says Hurst. "Quite simply put, if a stream is ten kilometres in length with only five kilometres accessible to coho, by colonizing, the resulting smolt production is from ten kilometres of stream." That principle is about to bring fish back to the Englishman River.

• Building up Baynes Sound

Some of the most beautiful areas on Vancouver Island lie on Baynes Sound which runs from Qualicum to Campbell River. This is also the site of some of the most intense fishing pressure in British

Columbia.

Eight streams that empty into the sound have been the traditional backbone of the Georgia Strait coho sports fishery. Returning fish in the area are also taken in commercial fisheries targeting on nearby runs. The eight streams — the Tsable River plus Washer, Cougar, Coal, Waterloo, Rosewall, Cook and Chef creeks — became the focus of a stock rebuilding effort in 1988.

On the recommendation of SEP biologist Bob Hurst, the eight streams are being enhanced and managed as one unit with stocks treated as a single gene pool. As he explains, this strategy solves two problems:

"It would be impractical to enhance each stock separately and we felt that there was not sufficient genetic difference to justify that effort. As well, there are just too few fish to work with in some of those systems right now."

The method is easy to understand. Thirty pair of wild adults are used to produce smolts for release at Rosewall hatchery. Returning adults from these releases are used as brood stock to produce fry for outplanting to the various streams, to augment populations in accessible areas, and to colonize habitat which is not accessible.

Because wild stocks are always used to produce the brood stock, the fry are never more than one generation removed from wild stock. It's an effective strategy for a situation like Baynes Sound, where returning fish are scarce.

Coho colonization should be very effective. Results from colonization work on the Trent River, carried out since 1981, bode well for Baynes Sound; returns there have run up to five times those experienced prior to the program.

Coho have always been a very popular target for sport fishing in Georgia Strait and today, with the necessity of restrictions on chinook catches, they are likely to face increased pressure. With some of the Vancouver Island streams already experiencing returns of as few as a dozen adults, the Baynes Sound project may have come just in time.

• Channels and fish multiply on the Indian River

The Indian River is a hard place to reach. It empties into the head of Indian Arm and the only ways to get there are boat, plane (or helicopter) or a long, tough trip over the restricted road through the watershed from Squamish. You might think that there would be little human activity there, but it is actually pretty busy. A major powerline runs along the river, there is an active logging operation and the area is also on the route proposed for the new gas pipeline. Like many other waterways, this one is under pressure.

There is a need to get enhancement underway in such places before further developments can deplete stocks and limit options. The success of the earlier Jack's Slough groundwater channel on the river prompted SEP Resource Restoration to look for other suitable sites nearby. They located three which were developed in 1988.

The largest of the new channels is located at Brandt Creek, upstream

The Cowichan Tribes responded to the Minister's Chinook initiative by doubling the CSEP project's chinook capacity over the past three years. They also assist scientists from Pacific Biological Station and operate a coho fry salvage program in cooperation with local PIP volunteers.

from the original Jack's Slough project. Here SEP identified an old river channel, parallel to the river and dry except during periods of very high water. Standard groundwater channel digging techniques, coupled with diversion of some of the flow from Brandt Creek, produced about one kilometre of new spawning area.

Site inspections in the fall showed good usage by chum, with up to 1,500 spawners using the new channel, and a sizable number of coho.

"We think a good portion of the coho that would usually spawn in the upper part of the Indian River used the channel," says biologist Matt Foy. "We also saw some chinook in there, although we did not spot any in the main stem. It will be some years before counts of returns can give us a real assessment, but that sort of fish utilization is very promising."

Also promising were the two smaller channels, Hixon and Tower, located below Jack's Slough. Although these, too, were used by chum and coho spawners, their main purpose is to provide good habitat for overwintering coho.

"Now we are trying to bring sidechannel technology down to a size for small streams," says Foy. "They are different, and it is technically more challenging, but we would like to be able to do ten small sites, rather than one large one."

Hixon and Tower channels on the Indian River may be just the first of many small but very productive projects for SEP's Community Programs Division.

This is the end product of any enhancement effort, thousands of healthy salmonid fry. These are being fed at Tenderfoot hatchery.

Looking Ahead

• Education gets a teacher hooked

SEP's 1988-89 educational effort was reflected in a report written by Nanaimo Grade 6/7 teacher Colleen World. In part, that report read:

"It was November 1988 that the salmon entered my life, along with Linda Bermbach, SEP education coordinator and her resource manual. To be honest, my first thought was 'terrific, a science unit prepared so I can concentrate my energy on separate math and language units.'

"But the more I organized my units, the more they (science, math, etc.) became integrated. Subconsciously I had followed the education philosophy of whole language, something I had planned to work toward, but not in my first year.

"Our introduction was a field trip to the Nanaimo River Hatchery, just south of Nanaimo. Typical of late November, it was a cold and rainy — but it was a day not easily forgotten.

"In small groups, we viewed and took part in an egg take and dissection, wandered through the daily operations and then we walked down to the river to observe the salmon in their natural environment.

"To see the expressions on the faces of my students and to hear questions they were asking, I knew we were all hooked."

That group of students went on to incubate salmon in a tank in their classroom, consider and discuss various dangers salmon face in some waterways and plan a newspaper on a marine theme. Said their teacher:

"Even though it is my first year of teaching and I am no salmon expert, I am pleased with the results and would recommend the program highly.

For I have a class full of experts now!"

• Science asks: What is happening out there?

Imagine this scenario. A rancher breeds cattle. He keeps the steers on his ranch until they are weaned, then turns them out to graze in a vast area about which he knows very little. Then he waits to see how many of his steers will survive to market size. If enough chance to make it, he makes a profit, if not....

Not very practical? Of course not, which is why everyone involved in west coast fishery management would like to know a lot more about what happens once juvenile salmonids enter the Pacific Ocean for periods of from two to seven years.

MASS, the Marine Survival of Salmon Program, was launched in 1987 to try to unravel some of those mysteries. The program is examining the ocean itself (the continental shelf structure, currents, salinity, temperatures and tides) as well as creatures in the ocean (salmon, the planktons they feed on and the predators that feed on them). Research is underway off the west coast of Vancouver Island and is centered on sockeye, coho and chinook salmon.

• What's for dinner?

During the period of peak Salmon migrations, D. Mackas and J. Forbes from the Institute of Ocean Sciences and E. MacIsaac from the West Vancouver Laboratory cruised Barkley Sound and the Alberni Inlet to sample the waters for various planktons.

One of the most interesting discoveries was that the distribution of zooplanktons was much different from that found by MASS in 1987, when high concentrations of zooplankton in the northeast corner of Barkley Sound coincided with high concentrations of sockeye smolts. The possibility of a link had been considered, but the 1988 results seem to deny it.

"Total zooplankton biomass [in 1988] was low in the regions where smolts were abundant (outer Alberni Inlet and Junction Passage). Highest zooplankton densities occurred in more saline water further out in Barkley Sound," notes their report.

As MASS progresses, this is one of the mysteries that may be resolved.

• Who is eating those smolts?

Predation studies in the waters of Barkley Sound have been carried out for the past two summers under principal investigator Brent Hargreaves.

Both Pacific Hake and Walleye Pollock were found to feed on juvenile salmon. Both species were located in greater numbers in 1988 than in 1987 and both were found to have consumed a higher percentage of salmon. In 1987, examination of stomach contents of hake indicated that 5.3 percent had eaten salmon. In 1988, the figure rose to 7.1 percent. Figures for pollock mirrored this trend, but were higher in both years; 27.3 percent in 1987 and 31.9 in 1988.

This was an intensive study in 1988 and was facilitated by volunteer participation by 14 members of SEP staff, each of whom spent three weeks working with the project.

Predation by birds is another element in the marine survival puzzle, especially for smolts as they first enter the estuary. For that reason, a count of marine birds over banks off the west coast of Vancouver Island was carried out in 1988 by Kees Vermeer of the Canadian Wildlife Service.

Populations of two fish-eating species, the Western Grebe and the Common Merganser, were found to peak in April and early May. Since that is a time when juvenile salmon are found in Alberni Inlet, a relationship is possible, but further studies would be needed to determine the impact this has on salmon survivals.

Enhancement is for everyone. Seniors often handle fry hauling at volunteer projects and help spread the word at mall displays and open house events. Groups of youngsters, like these, spearhead the Storm Drain Marking Program to warn against pollution from streets, driveways and gardens.

Annual Production Summary

Fish Production From SEP Facilities: 1988 Release Year

Community Economic Development Program				
BELLA BELLA	CHUM	1,103,336	20,963	14,527
	COHO	93,768	7,011	4,959
CHEHALIS R /LWFR	CHUM	3,063,750	21,446	9,059
CLAYOQUOT	COHO	524	4	2
	CHINOOK	107,938	1,511	718
COWICHAN RIVER	COHO	337,738	3,377	2,406
	CHINOOK	692,176	12,688	7,105
FORT BABINE	COHO	71,397	6,225	2,840
	CHINOOK	99,184	1,749	725
FORT ST JAMES	CHINOOK	121,441	911	273
HARTLEY BAY CREEK	COHO	56,118	1,999	1,414
KINCOLITH	COHO	36,329	3,423	1,686
	CHINOOK	33,105	662	196
KISPIOX RIVER	COHO	99,253	5,120	2,336
	CHINOOK	374,600	4,327	1,795
KITSUMKALUM RIVER	CHUM	131,834	2,241	1,504
	COHO	72,638	2,179	994
KLEMTU	CHUM	426,680	8,107	5,618
	COHO	56,616	5,662	4,004
LANG CHANNEL	PINK	375,000	9,375	6,938
	CHUM	650,000	9,100	4,004
MASSET	COHO	60,448	2,595	1,155
	CHINOOK	58,525	644	232
NANAIMO RIVER	CHUM	470,037	5,640	2,482
	COHO	196,499	1,965	1,400
	CHINOOK	615,559	12,311	6,894
NIMPKISH	CHUM	429,260	7,277	3,347
	COHO	6,739	54	39
	SOCKEYE	1,664,807	15,013	8,407
	CHINOOK	22,420	168	107
OWEEKENO	CHINOOK	269,985	3,240	1,475
P.HARDY/QUATSE	PINK	899,800	13,497	8,098
	CHUM	62,214	522	240
P.HARDY/STEPHENS	CHUM	237,867	1,665	733
	COHO	267,120	3,205	1,979
PENNY	CHINOOK	137,623	1,026	308
POWELL RIVER	PINK	618,000	9,270	6,860
	CHUM	307,506	3,690	1,624
	COHO	336,673	8,521	4,310
	CHINOOK	117,549	1,998	1,400
SAN JUAN RIVER	COHO	138,557	4,408	2,622
	CHINOOK	711,071	9,955	4,731
SECHELT	PINK	34,000	782	579
	CHUM	142,302	1,708	752
	COHO	82,179	6,370	3,222
	CHINOOK	124,979	2,360	1,653
SEYMOUR R	PINK	98,719	1,481	1,096
	CHUM	87,575	1,463	644
	COHO	103,786	5,404	2,734
	CHINOOK	99,790	1,694	1,187
	STEELHEAD	46,975	826	413
SKIDEGATE	CHUM	233,208	1,632	696
SLIAMMON RIVER	PINK	10,031	150	111
	CHUM	254,000	4,318	1,900
	COHO	25,030	1,203	609
TERRACE	CHINOOK	296,132	3,643	1,511
	STEELHEAD	5,379	54	32
THOMPSON RIVER NORTH	COHO	149,363	4,119	2,636
THORNTON CREEK/SWVI	COHO	344,835	10,557	6,279
	CHINOOK	105,205	1,473	700
TOBOGGAN CR	COHO	97,944	7,930	3,618
	CHINOOK	123,619	2,472	1,025
	STEELHEAD	131,511	1,315	789
Lake Enrichment Program				
GREAT CENTRAL LAKE	SOCKEYE	4,030,046	181,352	110,625
HENDERSON LAKE	SOCKEYE	146,490	6,592	4,021
KENNEDY LAKE	SOCKEYE	662,795	29,826	18,194
LONG LAKE	SOCKEYE	3,073,881	138,325	76,079
NIMPKISH LAKE	SOCKEYE	1,253,931	56,427	31,599
WOSS LAKE	SOCKEYE	1,210,592	54,477	30,507
Enhancement Operations				
BIG QUALICUM RIVER	CHUM	56,564,469	395,951	174,218
	COHO	1,111,678	111,168	79,207
	CHINOOK	6,134,313	122,686	68,704
	CUTTHROAT	13,004	1,300	871
	STEELHEAD	55,924	1,576	788
BIRKENHEAD RIVER	CHINOOK	84,863	636	264
CAPILANO RIVER	COHO	758,983	63,394	32,068
	CHINOOK	2,424,090	41,210	28,867
	CUTTHROAT	2,623	262	176
	STEELHEAD	104,915	1,353	677
CHEHALIS RIVER/BC	CHUM	24,533,896	417,076	176,177
	COHO	764,112	76,411	48,892
	CHINOOK	1,228,004	9,547	7,845
	CUTTHROAT	28,482	2,848	1,908
	STEELHEAD	95,252	3,425	2,055
CHEMAINUS RIVER	COHO	78,012	780	556
	CHINOOK	216,590	4,332	2,426
CHILLIWACK RIVER	CHUM	2,764,688	47,000	19,853
	COHO	1,706,288	170,629	109,177
	CHINOOK	1,519,756	19,996	16,431
	STEELHEAD	129,946	4,937	2,962
CLEARWATER R UPR/BC	CHINOOK	1,969,630	14,772	4,432
CONUMA RIVER	CHUM	10,734,608	182,488	80,295
	COHO	199,909	11,954	7,382
	CHINOOK	2,219,854	30,927	14,697
EAGLE RIVER/THOM	COHO	934,882	21,730	13,904
	CHINOOK	665,674	4,114	1,234
FULTON RIVER	SOCKEYE	59,525,000	589,298	220,397
GATES R./UPFR	SOCKEYE	5,679,393	56,226	15,001
INCH CREEK	CHUM	4,888,188	83,099	35,102
	COHO	417,385	39,161	25,057
	CHINOOK	123,934	2,107	1,731
	CUTTHROAT	36,674	3,667	2,457
JONES CREEK	PINK	509,927	12,748	6,292
	CHUM	210,758	1,475	623
KITIMAT RIVER	CHUM	4,330,373	73,616	51,016
	COHO	679,683	62,727	44,364
	CHINOOK	2,558,998	30,708	11,976
	CUTTHROAT	8,740	874	586
	STEELHEAD	48,328	1,933	967
LITTLE QUALICUM R	CHUM	39,425,391	275,978	121,430
	CHINOOK	4,367,284	87,346	48,914
	STEELHEAD	15,077	603	302
NADINA RIVER	SOCKEYE	17,607,000	174,309	46,506
NITINAT RIVER	CHUM	12,172,600	204,684	90,061
	COHO	139,001	3,126	1,859
	CHINOOK	7,131,223	68,470	32,537
PALLANT CREEK	CHUM	12,109,700	218,991	93,369
	COHO	344,212	8,605	3,831
	CHINOOK	84,118	631	227
PINKUT CREEK	SOCKEYE	45,003,000	445,530	166,628
PITT RIVER UPPER	SOCKEYE	3,847,936	36,018	9,610
PUNTLEDGE RIVER	PINK	2,862,711	57,110	34,266
	CHUM	4,052,036	68,885	30,309
	COHO	1,827,511	107,441	76,552
	CHINOOK	4,170,484	83,224	53,263
	CUTTHROAT	2,170	217	145
	STEELHEAD	31,228	1,124	562
QUESNEL RIVER	COHO	13,664	410	262
	CHINOOK	2,867,399	21,505	6,452

QUINSAM RIVER	PINK	8,456,097	150,062	90,037
	COHO	1,347,697	134,770	97,742
	CHINOOK	3,678,173	73,563	46,845
	STEELHEAD	64,340	1,323	662
ROBERTSON CREEK	COHO	1,144,494	57,225	34,035
	CHINOOK	8,682,797	118,850	56,478
	STEELHEAD	362,834	6,097	5,443
SETON RIVER LOWER	PINK	30,170,511	754,263	372,289
SHUSWAP RIVER	CHINOOK	1,925,800	14,444	4,333
SNOOTLI CREEK	CHUM	7,449,984	128,502	89,052
	COHO	61,532	1,846	1,306
	CHINOOK	2,234,952	16,762	6,537
	CUTTHROAT	28,174	451	302
	STEELHEAD	90,563	580	290
SPIUS CREEK	COHO	541,671	18,370	11,754
	CHINOOK	1,132,003	9,114	2,734
	STEELHEAD	402,931	4,029	2,417
TENDERFOOT CREEK	COHO	243,506	24,351	12,318
	CHINOOK	1,418,055	24,107	16,886
	STEELHEAD	62,184	398	199
WEAVER CREEK/BC	PINK	810,000	20,250	9,995
	CHUM	774,942	5,425	2,292
	SOCKEYE	27,962,000	276,824	73,857
WHITEHORSE	CHINOOK	355,433	889	33
Province of B.C.				
COWICHAN LAKE BCFW	CUTTHROAT	12,755	1,276	855
	STEELHEAD	153,117	6,026	3,013
FRASER VALLEY BCFW	CUTTHROAT	27,707	2,771	1,857
	STEELHEAD	213,387	2,612	1,567
VANCOUVER IS BCFW	CUTTHROAT	6,424	103	69
	STEELHEAD	169,942	1,980	990
Small Projects Unit				
ALOUETTE RIVER	PINK	537,187	8,058	3,977
	CHUM	1,097,556	18,658	7,881
	COHO	33,388	3,339	2,136
	CUTTHROAT	45,096	4,510	3,022
	STEELHEAD	44,838	1,794	1,076
ANDESITE CHANNEL	CHUM	11,200	157	105
	COHO	1,050	158	72
B.C.RAIL.CHAN.	CHUM	1,000,000	14,000	6,160
	COHO	3,000	450	228
BAYNES SOUND STR.	CHUM	75,000	525	231
	COHO	47,837	2,361	1,682
BILLY HARRIS SLOUGH	CHUM	1,480,000	20,720	8,752
	COHO	11,240	1,686	1,079
BONSALL SLOUGH	CHUM	1,200,000	16,800	7,392
CHILQUA CREEK	CHUM	500,000	7,000	2,957
	COHO	1,200	180	115
DEADMAN CHAN.	COHO	1,200	180	115
DUDLEY MARSH	COHO	4,380	44	31
ED LEON SLOUGH	PINK	1,750,000	43,750	21,594
	CHUM	1,544,000	21,616	9,131
	COHO	8,700	1,305	835
ENGLISHMAN RIVER	CHUM	175,000	1,225	539
	COHO	74,375	744	530
	CHINOOK	117,214	2,344	1,313
FISHWEIR CHANNEL	PINK	250,000	6,250	4,625
HICKS CREEK POND	CHUM	25,000	350	148
	COHO	8,000	1,200	768
HOPEDALE CHANNEL	CHUM	56,000	784	331
HOPEDALE SLOUGH	CHUM	150,000	2,100	887
	COHO	4,000	600	384
JACK SLOUGH	CHUM	840,000	11,760	5,174
JUDD SLOUGH	CHUM	2,600,000	36,400	16,016
	COHO	7,800	1,170	592
KITSUMKALUM LAKE	SOCKEYE	250,000	2,475	926
KITWANCOOL CHAN.	PINK	9,750	244	127
	COHO	100	15	7
MAMQUAM RIVER	PINK	750,000	18,750	13,875
	CHUM	1,500,000	21,000	9,240
	COHO	1,100	165	83
MASHITER CHANNEL	CHUM	420,000	5,880	2,587
MCNAB CHANNEL	CHUM	87,500	1,225	539
	COHO	1,500	225	114
MOODIE'S CHAN.	CHUM	1,500,000	21,000	9,240
	COHO	9,900	1,485	751
PARADISE CHAN LOWER	CHUM	1,500,000	21,000	9,240
	COHO	4,500	675	341
PARADISE CHAN UPPER	CHUM	1,300,000	18,200	8,008
	COHO	5,500	825	417
PEACH CREEK	CHUM	28,000	392	166
	COHO	13,500	2,025	1,296
PRETTYS CHANNEL	CHUM	200,000	2,800	1,183
RAILROAD CREEK	CHUM	350,000	4,900	2,070
	COHO	250	38	24
ROTARY PARK	CHUM	1,000,000	14,000	6,160
RYDER CREEK	CHUM	150,000	2,100	887
SEABIRD CHANNEL	CHUM	18,900	265	112
	COHO	3,000	450	288
	SOCKEYE	14,100	140	37
SMOKEHOUSE CHAN.	CHUM	685,000	9,590	4,051
VAN.BAY CHAN	CHUM	169,500	2,373	1,044
VANCOUVER BAY	PINK	1,400,000	21,000	15,540
	CHUM	84,000	828	364
	CHINOOK	48,822	780	546
	STEELHEAD	7,500	73	37
WELDWOOD CHANNEL	CHUM	280,000	3,920	1,725
WESTHOLME CHAN	CHUM	1,500,000	21,000	9,240
	COHO	100	15	11
WORTH CREEK	CHUM	350,000	4,900	2,070
	COHO	1,712	257	164
Public Involvement Program				
COMMUNITY ADVISOR:VANC. IS. N.				
	CHUM	162,013	2,322	1,025
	COHO	597,216	9,989	6,434
	CHINOOK	1,121,994	16,041	8,218
	STEELHEAD	9,804	98	46
COMMUNITY ADVISOR:VANC. IS. S.				
	CHUM	76,946	599	264
	COHO	306,152	4,919	3,193
	CHINOOK	344,290	2,582	1,255
COMMUNITY ADVISOR:VAN.IS.CTRL.				
	PINK	1,600,000	24,800	14,880
	CHUM	40,000	280	123
	COHO	698,779	19,081	10,978
	CHINOOK	346,193	6,924	3,877
	CUTTHROAT	4,500	72	48
	STEELHEAD	4,940	198	99
COMMUNITY ADVISOR:SUNSHINE CST				
	PINK	22,186	333	246
	CHUM	421,635	4,979	2,191
	COHO	208,249	5,861	3,004
	SOCKEYE	57,110	514	360
	CUTTHROAT	2,291	229	153
	STEELHEAD	32,000	320	160
COMMUNITY ADVISOR: Q.C.I.				
	CHUM	223,064	3,387	1,444
	COHO	395,959	7,913	3,524
	STEELHEAD	6,536	65	33
COMMUNITY ADVIS.:CTRL INTERIOR				
	COHO	48,831	761	488
	CHINOOK	146,698	1,100	331
	STEELHEAD	9,000	90	54

COMMUNITY ADVIS.:N.COAST/INTER				
	COHO	300,865	6,214	2,681
	CHINOOK	16,000	176	5
COMM. ADVIS.:FRASER R. S/SIDE				
	CHUM	314,000	2,923	1,242
	COHO	204,738	7,206	3,981
	CHINOOK	470	12	8
	CUTTHROAT	9,067	907	608
	STEELHEAD	7,622	305	153
COMM. ADVIS.:FRASER R. N/SIDE				
	CHUM	289,172	4,134	1,784
	COHO	230,647	11,947	6,910
	CHINOOK	178,504	2,772	1,942
	CUTTHROAT	10,973	1,097	735
	STEELHEAD	6,822	206	124

Fishways and Unmanned Channels

PINK	11,550,000	173,250	115,932
CHUM	2,377,200	16,640	10,383
COHO	84,375	675	493

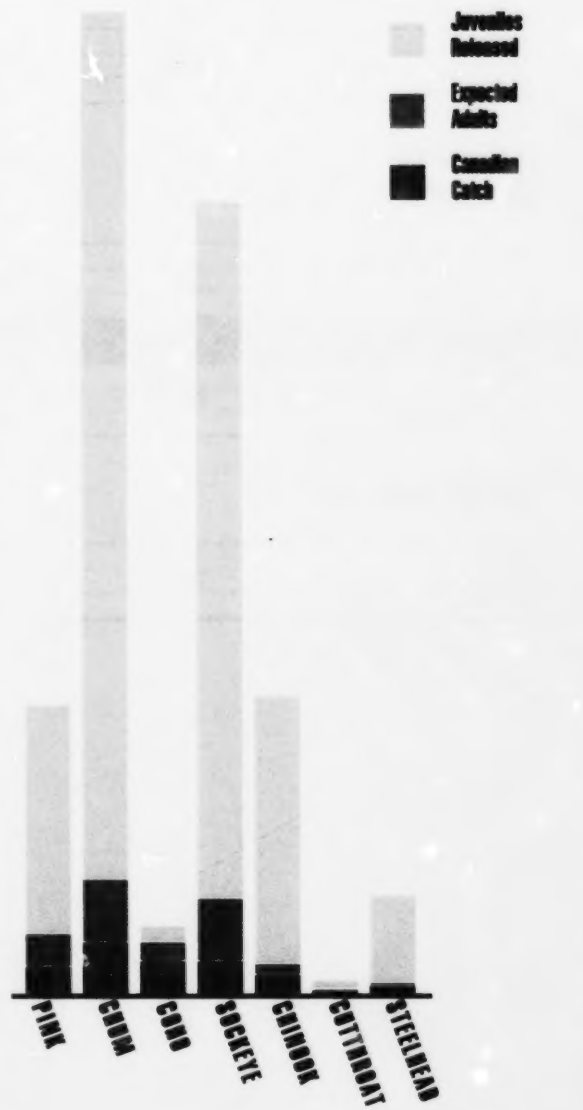
Program Areas

COMMUNITY ECONOMIC DEV. PROGRAM			
PINK	2,035,550	34,555	23,682
CHUM	7,599,569	89,772	47,130
COHO	2,832,757	94,625	53,633
SOCKEYE	1,664,807	15,013	8,407
CHINOOK	4,110,901	62,832	32,035
STEELHEAD	242,617	4,262	2,268
FISHWAYS AND UNMANNED CHANNELS			
PINK	11,550,000	173,250	115,932
CHUM	2,377,200	16,640	10,383
COHO	84,375	675	493
LAKE ENRICHMENT PROGRAM			
SOCKEYE	10,377,735	466,999	271,025
ENHANCEMENT OPERATIONS			
PINK	42,809,246	994,433	512,879
CHUM	180,011,633	2,103,170	963,797
COHO	12,314,220	914,098	600,266
SOCKEYE	159,624,329	1,578,205	531,999
CHINOOK	57,193,427	799,940	433,846
CUTTHROAT	119,867	9,619	6,445
STEELHEAD	1,463,522	27,378	17,324
PUBLIC INVOLVEMENT PROGRAM			
PINK	1,622,186	25,133	15,126
CHUM	1,526,830	18,624	8,073
COHO	2,991,436	70,891	41,193
SOCKEYE	57,110	514	360
CHINOOK	2,154,149	29,607	15,636
CUTTHROAT	26,831	2,305	1,544
STEELHEAD	76,724	1,282	669
PROVINCE OF B.C.			
CUTTHROAT	46,886	4,150	2,781
STEELHEAD	536,446	10,618	5,570
SMALL PROJECTS UNIT			
PINK	4,696,937	98,052	59,738
CHUM	21,876,656	307,468	133,630
COHO	247,332	19,592	12,063
SOCKEYE	264,100	2,615	963
CHINOOK	166,036	3,124	1,859
CUTTHROAT	45,096	4,510	3,022
STEELHEAD	52,338	1,867	1,113

Species Production Summary

Fish Production From SEP Facilities: 1988 Release Year

PINK	62,713,919	1,325,423	727,357
CHUM	213,391,888	2,535,674	1,163,013
COHO	18,470,120	1,099,881	707,648
SOCKEYE	171,988,081	2,063,346	812,754
CHINOOK	63,624,513	895,503	483,376
CUTTHROAT	238,680	20,584	13,792
STEELHEAD	2,371,647	45,407	26,944



SEP Contribution to 1988 Commercial and Sport Catches

North Coast Commercial

Total SEP	25,475	33,181	528,268	5,880	737,840
Total Catch	228,208	556,713	2,873,789	21,330,615	2,885,489
SEP Contribution	11.2	6.0	18.4	0	25.6

South Coast Commercial

Total SEP	26,020	253,937	1,880,746	256,617	445,674
Total Catch	490,091	2,116,164	3,127,905	1,491,430	815,209
SEP Contribution	5.3	12.0	60.1	17.2	54.7

Fraser River Commercial

Total SEP	727	13,104	38,282	0	234,938
Total Catch	9,972	31,416	86,104	827	728,098
SEP Contribution	7.3	41.7	44.5	0	32.3
[redacted]					
Total SEP	**52,222**	**300,222**	**2,447,296**	**262,497**	**1,418,452**
Total Catch	**728,271**	**2,704,293**	**6,087,798**	**22,822,872**	**4,428,796**
SEP Contribution	**7.2**	**11.1**	**40.2**	**1.2**	**32.0**

Georgia Strait Sport

Total SEP	17,766	416,470
Total Catch	119,117	1,084,790
SEP Contribution	14.9	38.4